Yocto at Balena

Building ~70 Unique OS’es for IoT Devices

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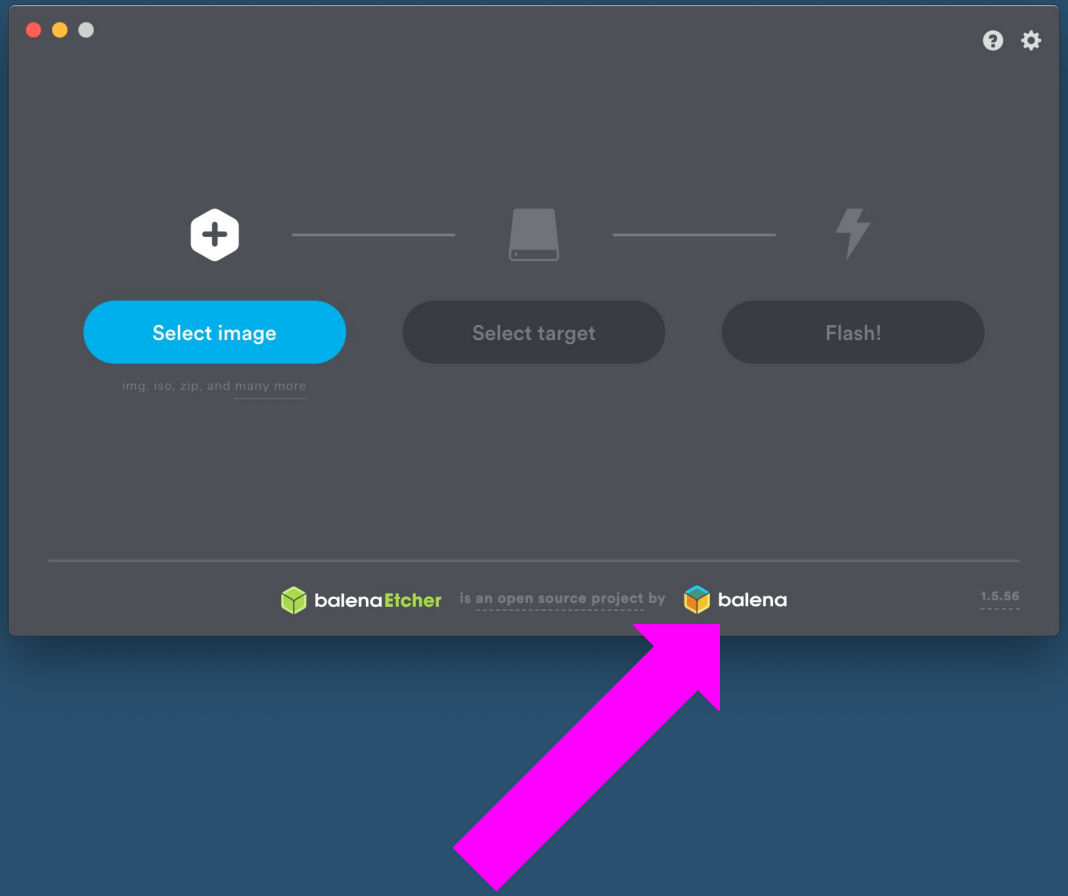
Who is Balena?

Etcher, anyone?



You could also use `dd`

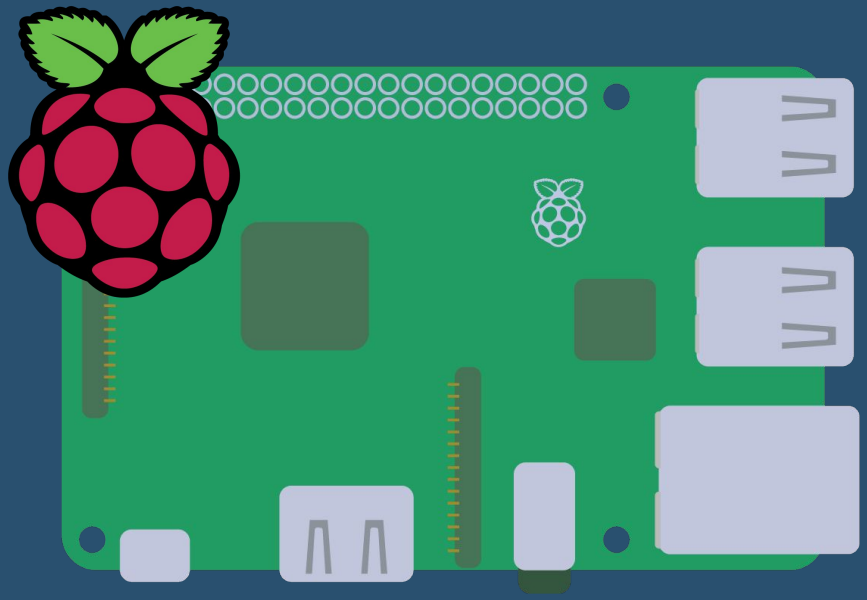
balena

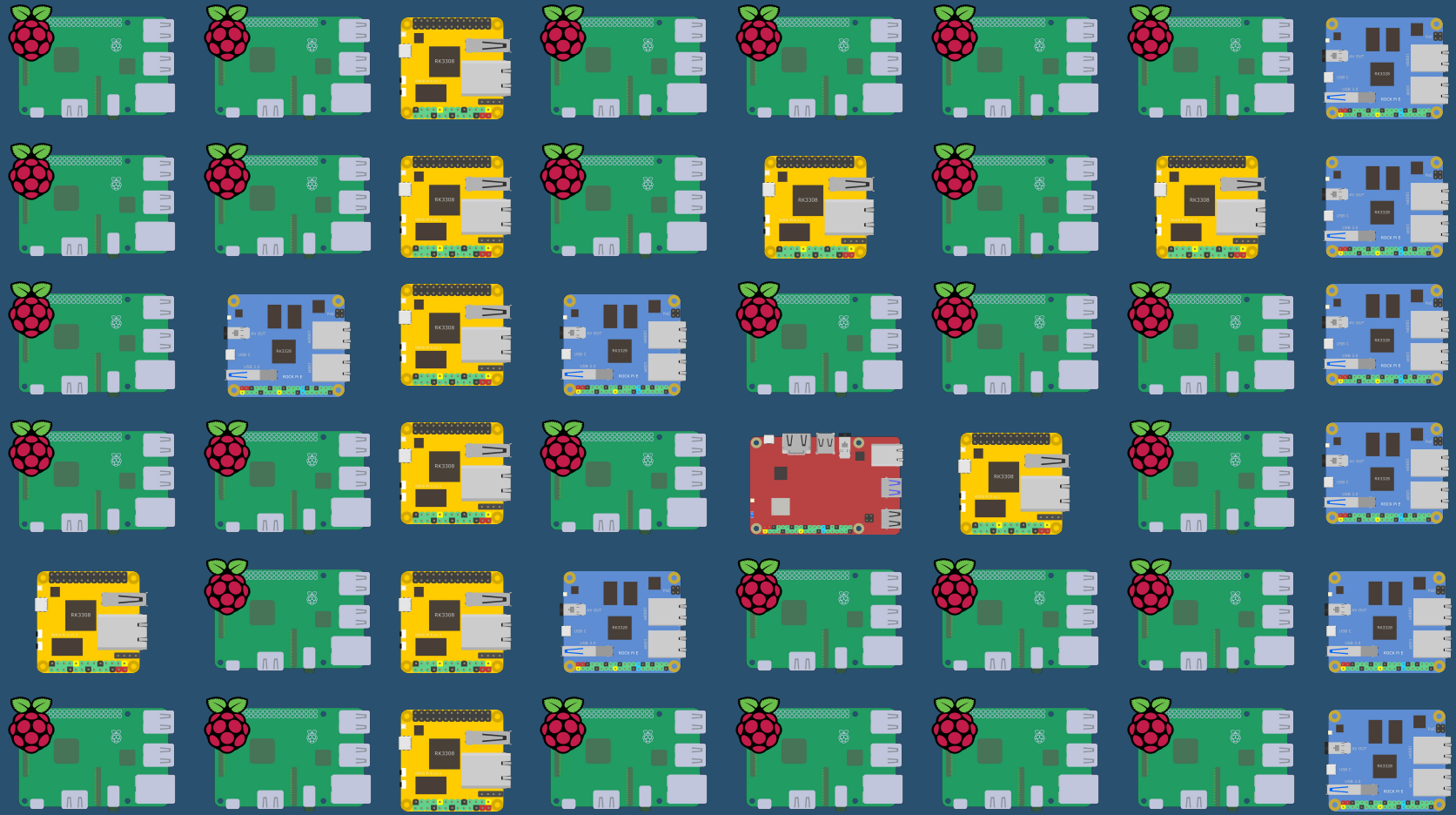
"Platform built to develop, deploy, and manage fleets of connected devices at scale."

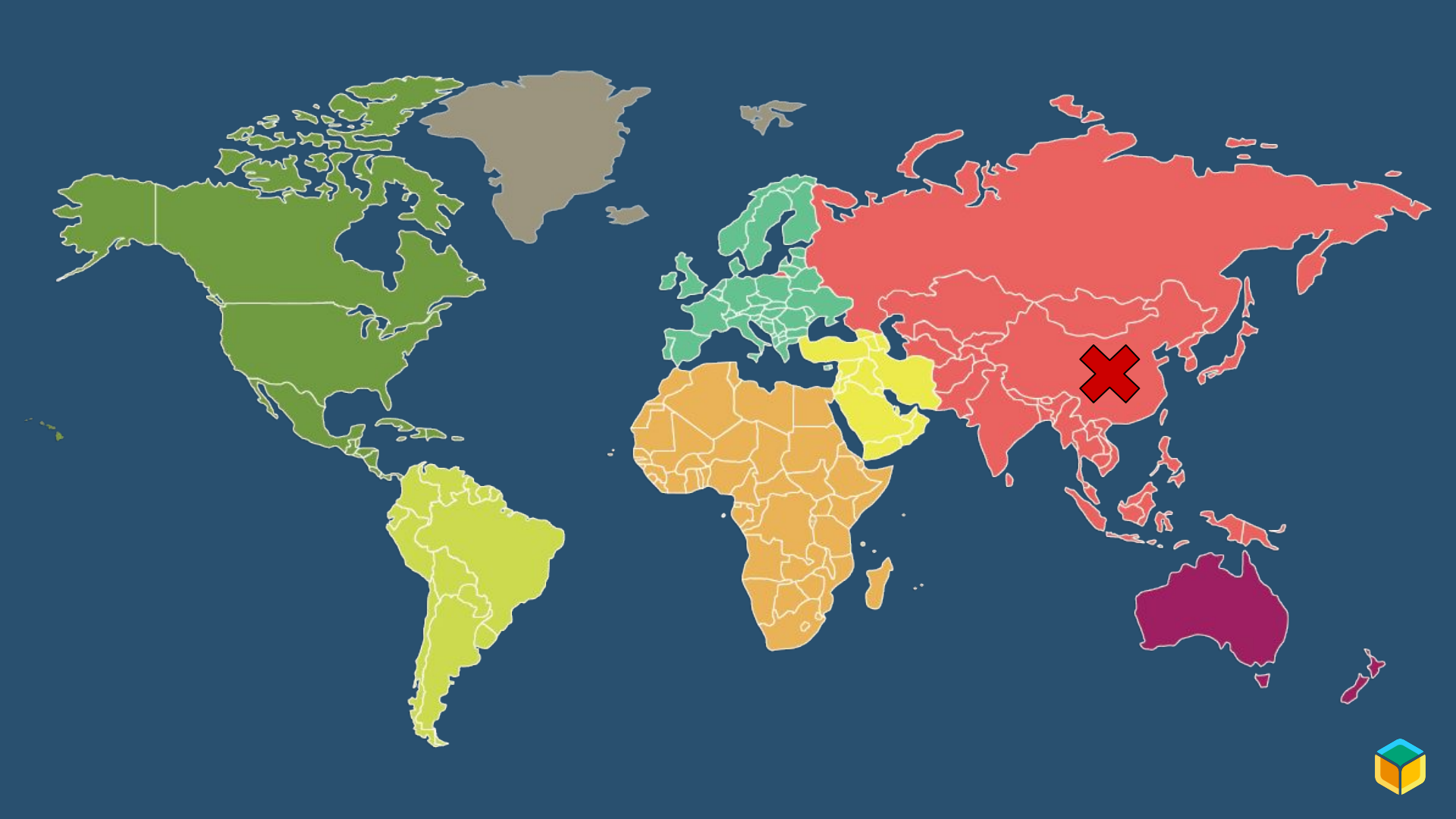
- balenaCloud
  - Web-based control of IoT devices, broken down by Applications, Devices, Workloads, and more
  - Terminal access to device, logs, container build info, and more.
- balenaOS
  - Based on Yocto Linux
- balenaEngine
  - Container runtime

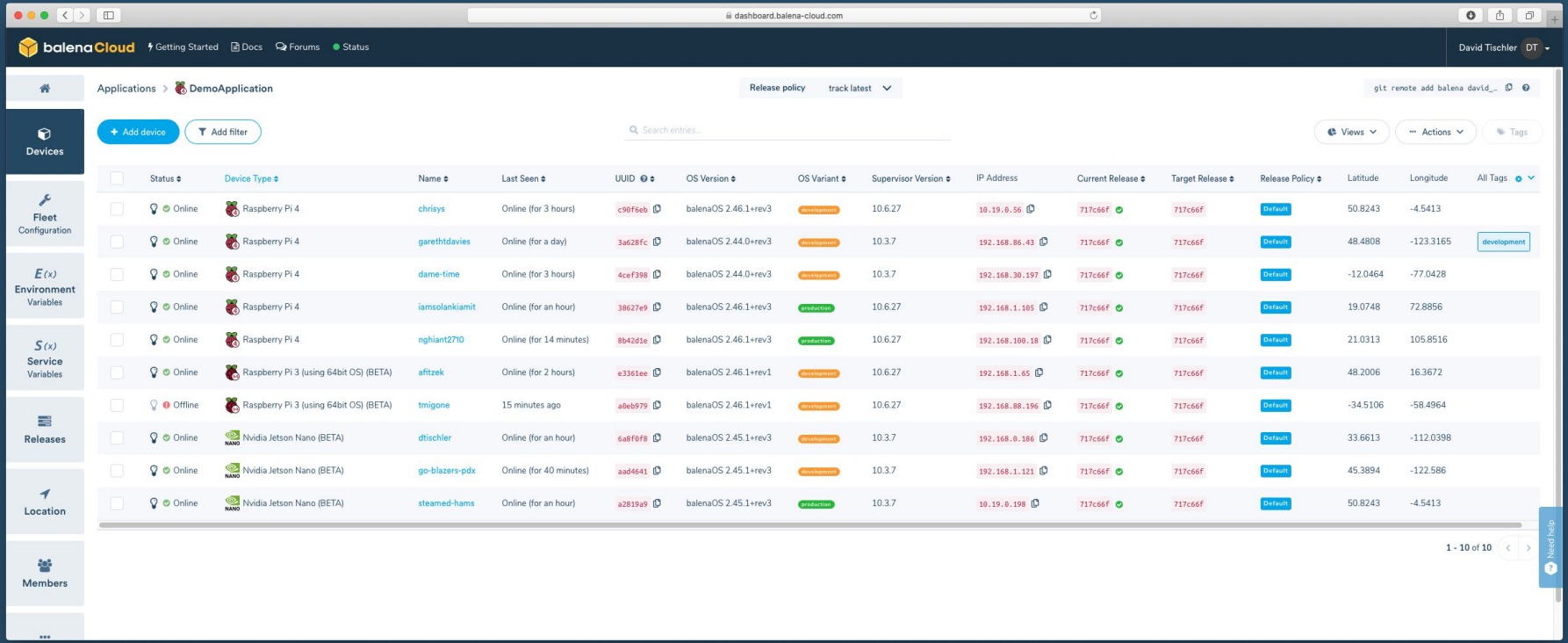
balena

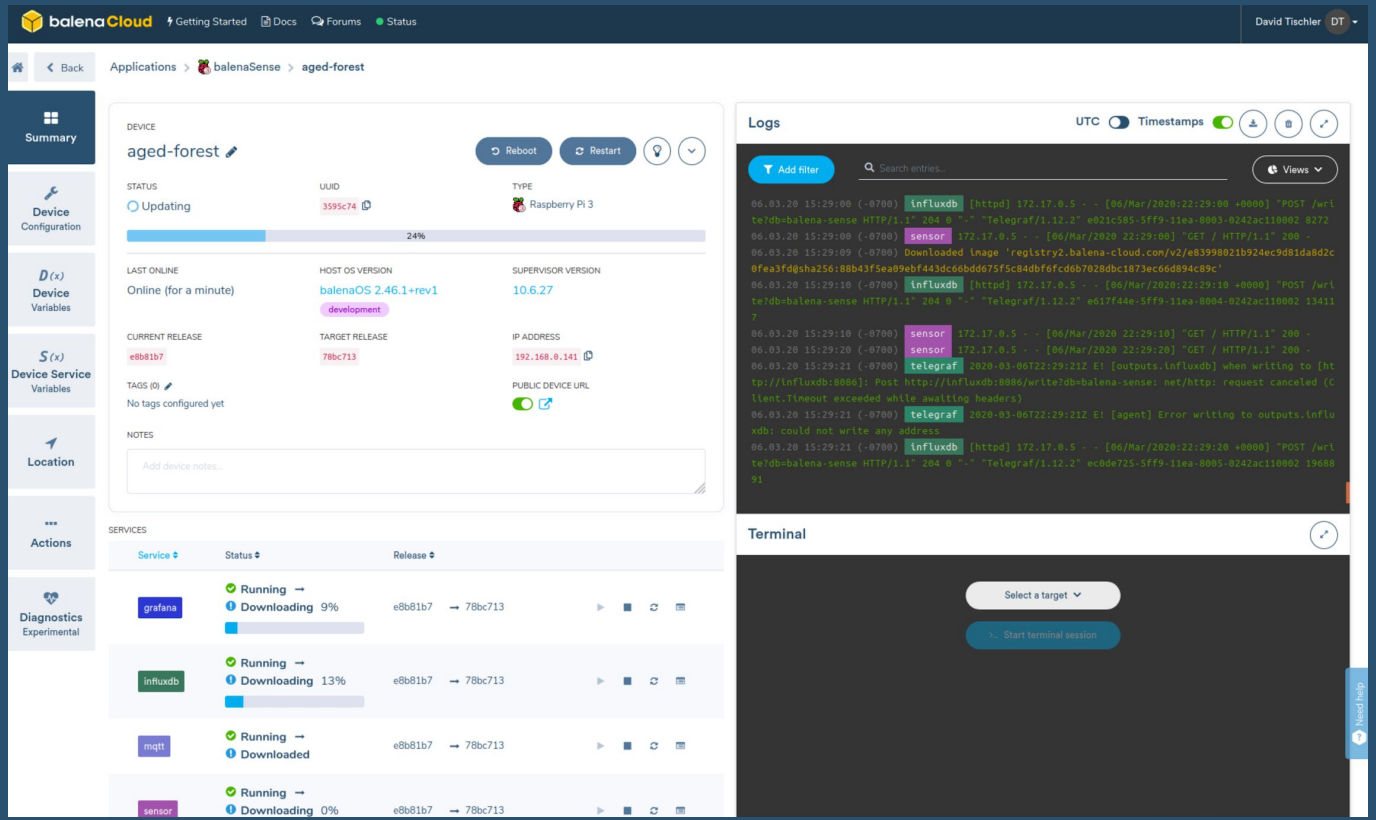
What do we mean by IoT “Fleet Management”?

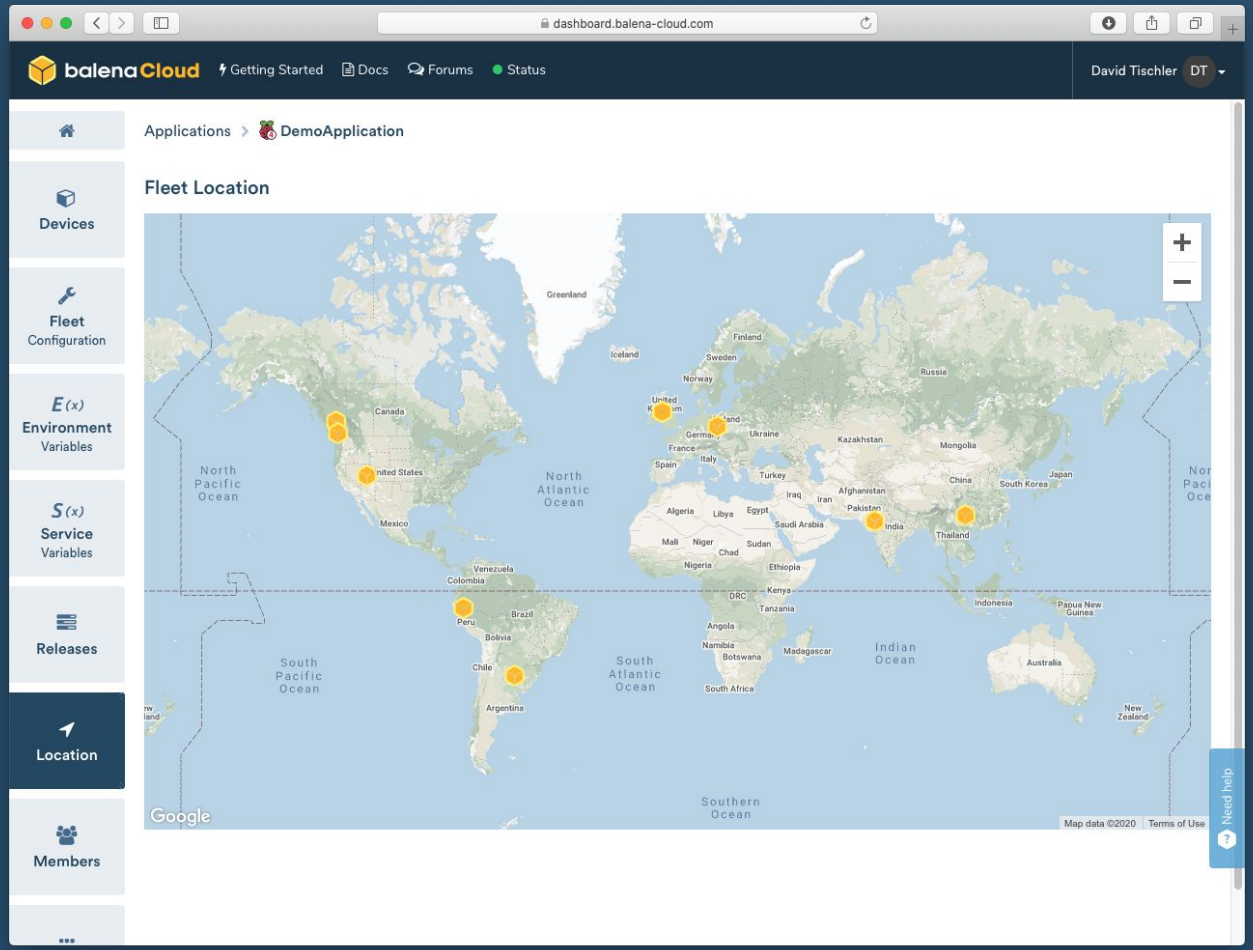



RK3308
RK3328
RK3329
RK3288
ROCK Pi E




dashboard.balena-cloud.com
balenaCloud
Getting Started
Docs
Forums
Status
David Tischler DT
Applications
DemoApplication
Release policy
track latest
git remote add balena david_...
Devices
Fleet Configuration
Environment Variables
Service Variables
Releases
Location
Members
Add device
Add filter
Search entries...
Views
Actions
Tags
Status
Device Type
Name
Last Seen
UUID
OS Version
OS Variant
Supervisor Version
IP Address
Current Release
Target Release
Release Policy
Latitude
Longitude
All Tags
Online
Raspberry Pi 4
chrisys
Online (for 3 hours)
c90f6eb
balenaOS 2.46.1+rev3
development
10.6.27
10.19.0.56
717c66f
717c66f
Default
50.8243
-4.5413
Online
Raspberry Pi 4
garethtdavies
Online (for a day)
3a628fc
balenaOS 2.44.0+rev3
development
10.3.7
192.168.86.43
717c66f
717c66f
Default
48.4808
-123.3165
development
Online
Raspberry Pi 4
dame-time
Online (for 3 hours)
4cef398
balenaOS 2.44.0+rev3
development
10.3.7
192.168.30.197
717c66f
717c66f
Default
-12.0464
-77.0428
Online
Raspberry Pi 4
iamsolankiamit
Online (for an hour)
38627e9
balenaOS 2.46.1+rev3
production
10.6.27
192.168.1.105
717c66f
717c66f
Default
19.0748
72.8856
Online
Raspberry Pi 4
nghiant2710
Online (for 14 minutes)
8b42d1e
balenaOS 2.46.1+rev3
production
10.6.27
192.168.100.18
717c66f
717c66f
Default
21.0313
105.8516
Online
Raspberry Pi 3 (using 64bit OS) (BETA)
afitzek
Online (for 2 hours)
e3361ee
balenaOS 2.46.1+rev1
development
10.6.27
192.168.1.65
717c66f
717c66f
Default
48.2006
16.3672
Offline
Raspberry Pi 3 (using 64bit OS) (BETA)
tmigone
15 minutes ago
a0eb979
balenaOS 2.46.1+rev1
development
10.6.27
192.168.88.196
717c66f
717c66f
Default
-34.5106
-58.4964
Online
Nvidia Jetson Nano (BETA)
dtischler
Online (for an hour)
6a8f0f8
balenaOS 2.45.1+rev3
development
10.3.7
192.168.0.186
717c66f
717c66f
Default
33.6613
-112.0398
Online
Nvidia Jetson Nano (BETA)
go-blazers-pdx
Online (for 40 minutes)
aad4641
balenaOS 2.45.1+rev3
development
10.3.7
192.168.1.121
717c66f
717c66f
Default
45.3894
-122.586
Online
Nvidia Jetson Nano (BETA)
steamed-hams
Online (for an hour)
a2819a9
balenaOS 2.45.1+rev3
production
10.3.7
10.19.0.198
717c66f
717c66f
Default
50.8243
-4.5413
1 - 10 of 10
Need help


balenaCloud
Getting Started
Docs
Forums
Status
David Tischler DT
Back
Applications
balenaSense
aged-forest
Summary
Device Configuration
Device Variables
Device Service Variables
Location
Actions
Diagnostics Experimental
DEVICE
aged-forest
Reboot
Restart
STATUS
Updating
UUID
3595c74
TYPE
Raspberry Pi 3
24%
LAST ONLINE
Online (for a minute)
HOST OS VERSION
balenaOS 2.46.1+rev1
development
SUPERVISOR VERSION
10.6.27
CURRENT RELEASE
e8b81b7
TARGET RELEASE
78bc713
IP ADDRESS
192.168.0.141
TAGS (0)
No tags configured yet
PUBLIC DEVICE URL
NOTES
Add device notes...
SERVICES
Service
Status
Release
grafana
Running
Downloading 9%
e8b81b7 → 78bc713
influxdb
Running
Downloading 13%
e8b81b7 → 78bc713
mqtt
Running
Downloaded
e8b81b7 → 78bc713
sensor
Running
Downloading 0%
e8b81b7 → 78bc713
Logs
UTC
Timestamps
Add filter
Search entries...
Views
06.03.20 15:29:00 (-0700) influxdb [httpd] 172.17.0.5 - - [06/Mar/2020:22:29:00 +0000] "POST /write?db=balena-sense HTTP/1.1" 204 0 "-" "Telegraf/1.12.2" e021c585-5ff9-11ea-8003-0242ac110002 8272
06.03.20 15:29:00 (-0700) sensor 172.17.0.5 - - [06/Mar/2020 22:29:00] "GET / HTTP/1.1" 200 -
06.03.20 15:29:09 (-0700) Downloaded image 'registry2.balena-cloud.com/v2/e83998021b924ec9d81da8d2c0fea3fd@sha256:88b43f5ea09ebf443dc66bdd675f5c84dbf6fcd6b7028dbc1873ec66d894c89c'
06.03.20 15:29:10 (-0700) influxdb [httpd] 172.17.0.5 - - [06/Mar/2020:22:29:10 +0000] "POST /write?db=balena-sense HTTP/1.1" 204 0 "-" "Telegraf/1.12.2" e617f44e-5ff9-11ea-8004-0242ac110002 13411
06.03.20 15:29:10 (-0700) sensor 172.17.0.5 - - [06/Mar/2020 22:29:10] "GET / HTTP/1.1" 200 -
06.03.20 15:29:20 (-0700) sensor 172.17.0.5 - - [06/Mar/2020 22:29:20] "GET / HTTP/1.1" 200 -
06.03.20 15:29:21 (-0700) telegraf 2020-03-06T22:29:21Z E! [outputs.influxdb] when writing to [http://influxdb:8086]: Post http://influxdb:8086/write?db=balena-sense: net/http: request canceled (Client.Timeout exceeded while awaiting headers)
06.03.20 15:29:21 (-0700) telegraf 2020-03-06T22:29:21Z E! [agent] Error writing to outputs.influxdb: could not write any address
06.03.20 15:29:21 (-0700) influxdb [httpd] 172.17.0.5 - - [06/Mar/2020:22:29:20 +0000] "POST /write?db=balena-sense HTTP/1.1" 204 0 "-" "Telegraf/1.12.2" ec0de725-5ff9-11ea-8005-0242ac110002 19688
Terminal
Select a target
Start terminal session
Need help


dashboard.balena-cloud.com
balena Cloud
Getting Started
Docs
Forums
Status
David Tischler DT
Applications
DemoApplication
Devices
Fleet Configuration
Environment Variables
Service Variables
Releases
Location
Members
Fleet Location
Greenland
Iceland
Finland
Sweden
Norway
Russia
Canada
Ukraine
Kazakhstan
Mongolia
France
Spain
Italy
Turkey
China
South Korea
Japan
Afghanistan
Pakistan
India
Thailand
Algeria
Libya
Egypt
Saudi Arabia
Iraq
Iran
Mali
Niger
Chad
Sudan
Nigeria
Ethiopia
Mexico
Venezuela
Colombia
Peru
Brazil
Bolivia
Chile
Argentina
DRC
Kenya
Tanzania
Angola
Namibia
Botswana
Madagascar
South Africa
Indonesia
Papua New Guinea
Australia
New Zealand
North Pacific Ocean
North Atlantic Ocean
South Pacific Ocean
South Atlantic Ocean
Indian Ocean
Southern Ocean
Google
Map data ©2020
Terms of Use
Need help

Architecture

balenaOS

Built on Yocto Linux, Optimized for Embedded Devices and IoT Usage

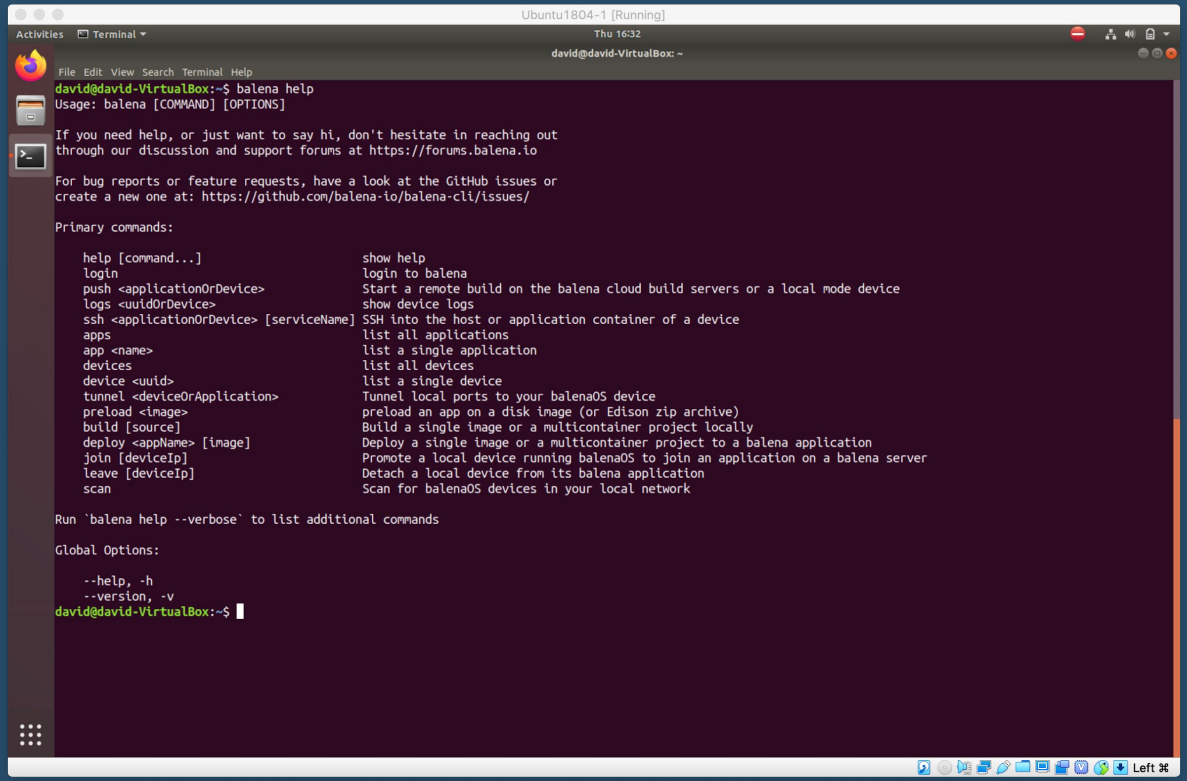
- Minimal by design (increased security)
- Less RAM / resource requirements
- Redundant RootFS partitions
- More tolerant of power loss
- Minimized SD Card writes

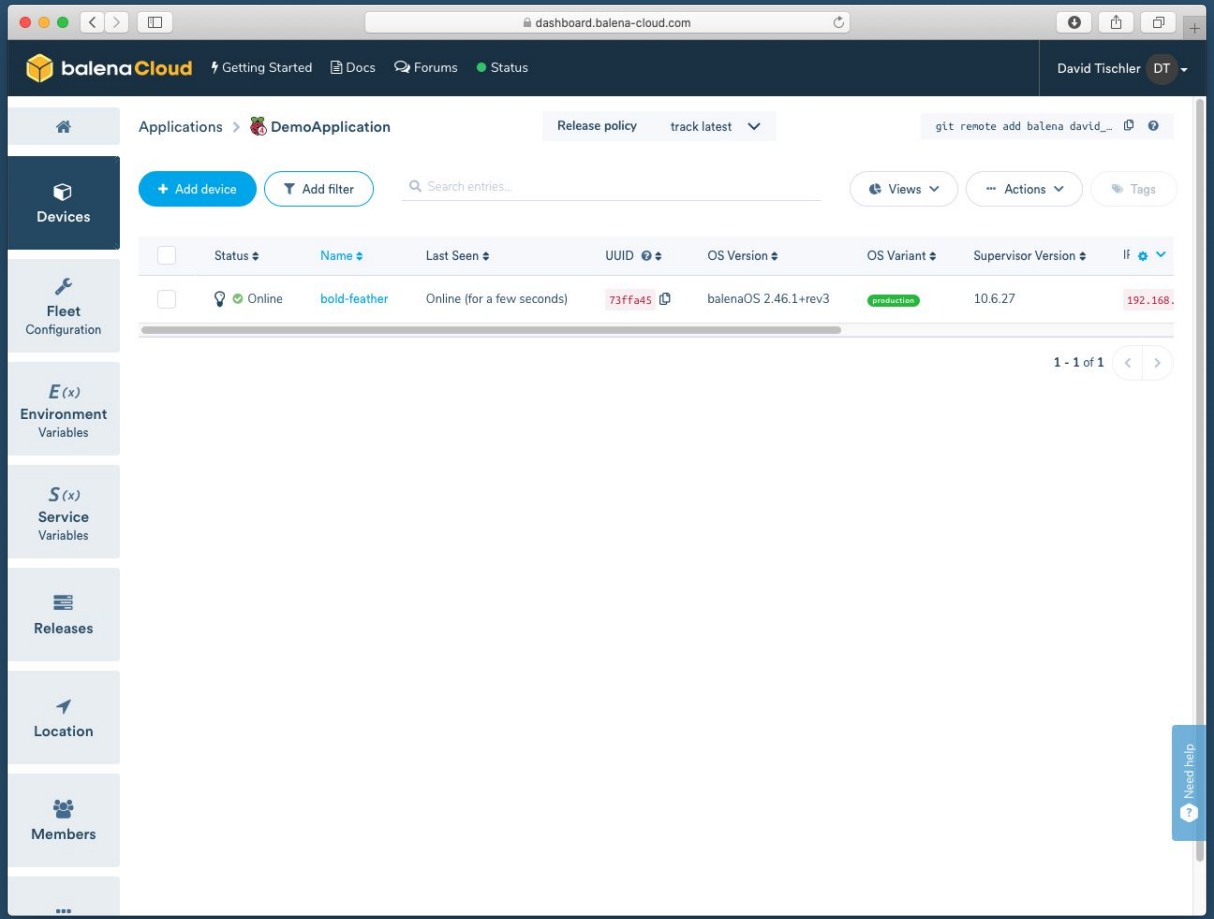
balenaEngine

Container engine built for Embedded and IoT use-cases, based on the Moby Project from Docker

- Minimal by design
- Less RAM / resource requirements
- Delta pulls to save bandwidth
- Fault tolerance on container pulls

balenaEngine


Ubuntu1804-1 [Running]
Activities
Terminal
Thu 16:32
david@david-VirtualBox: ~
File Edit View Search Terminal Help
david@david-VirtualBox:~$ balena help
Usage: balena [COMMAND] [OPTIONS]
If you need help, or just want to say hi, don't hesitate in reaching out
through our discussion and support forums at https://forums.balena.io
For bug reports or feature requests, have a look at the GitHub issues or
create a new one at: https://github.com/balena-io/balena-cli/issues/
Primary commands:
help [command...] show help
login login to balena
push <applicationOrDevice> Start a remote build on the balena cloud build servers or a local mode device
logs <uuidOrDevice> show device logs
ssh <applicationOrDevice> [serviceName] SSH into the host or application container of a device
apps list all applications
app <name> list a single application
devices list all devices
device <uuid> list a single device
tunnel <deviceOrApplication> Tunnel local ports to your balenaOS device
preload <image> preload an app on a disk image (or Edison zip archive)
build [source] Build a single image or a multicontainer project locally
deploy <appName> [image] Deploy a single image or a multicontainer project to a balena application
join [deviceIp] Promote a local device running balenaOS to join an application on a balena server
leave [deviceIp] Detach a local device from its balena application
scan Scan for balenaOS devices in your local network
Run `balena help --verbose` to list additional commands
Global Options:
--help, -h
--version, -v
david@david-VirtualBox:~$
Left ⌘


dashboard.balena-cloud.com
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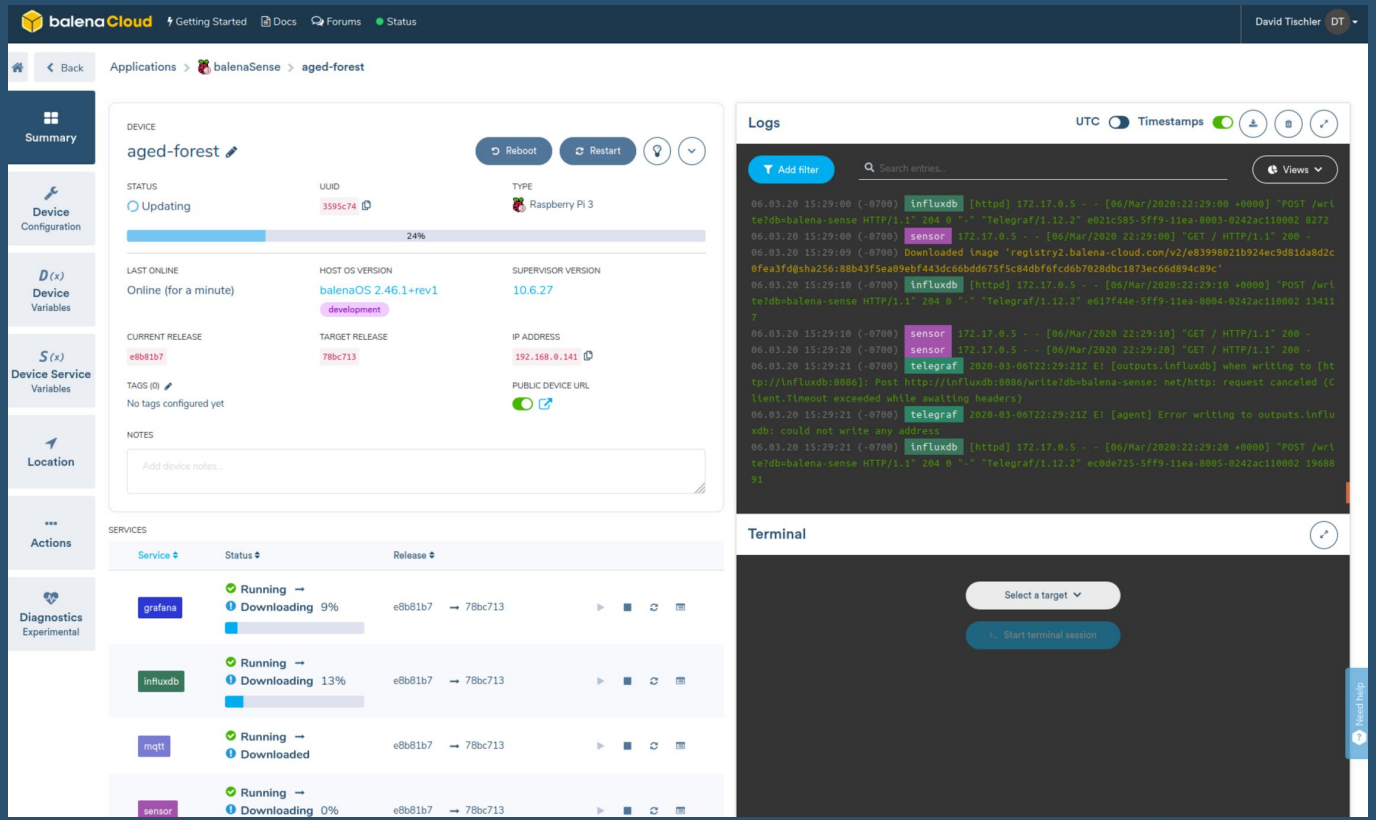
Status
David Tischler
DT
Applications
DemoApplication
Release policy
track latest
git remote add balena david_...
Devices
Fleet Configuration
Environment Variables
Service Variables
Releases
Location
Members
+ Add device
Add filter
Search entries...
Views
Actions
Tags
Status
Name
Last Seen
UUID
OS Version
OS Variant
Supervisor Version
Online
bold-feather
Online (for a few seconds)
73ffa45
balenaOS 2.46.1+rev3
production
10.6.27
192.168.
1 - 1 of 1
Need help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aged-forest
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Device Variables
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DEVICE
aged-forest
Reboot
Restart
STATUS
Updating
UUID
3595c74
TYPE
Raspberry Pi 3
24%
LAST ONLINE
Online (for a minute)
HOST OS VERSION
balenaOS 2.46.1+rev1
development
SUPERVISOR VERSION
10.6.27
CURRENT RELEASE
e8b81b7
TARGET RELEASE
78bc713
IP ADDRESS
192.168.0.141
TAGS (0)
No tags configured yet
PUBLIC DEVICE URL
NOTES
Add device notes...
SERVICES
Service
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grafana
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e8b81b7 → 78bc713
influxdb
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mqtt
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Downloaded
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06.03.20 15:29:00 (-0700) sensor 172.17.0.5 - - [06/Mar/2020 22:29:00] "GET / HTTP/1.1" 200 -
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06.03.20 15:29:10 (-0700) influxdb [httpd] 172.17.0.5 - - [06/Mar/2020:22:29:10 +0000] "POST /write?db=balena-sense HTTP/1.1" 204 0 "-" "Telegraf/1.12.2" e617f44e-5ff9-11ea-8004-0242ac110002 13411
06.03.20 15:29:10 (-0700) sensor 172.17.0.5 - - [06/Mar/2020 22:29:10] "GET / HTTP/1.1" 200 -
06.03.20 15:29:20 (-0700) sensor 172.17.0.5 - - [06/Mar/2020 22:29:20] "GET / HTTP/1.1" 200 -
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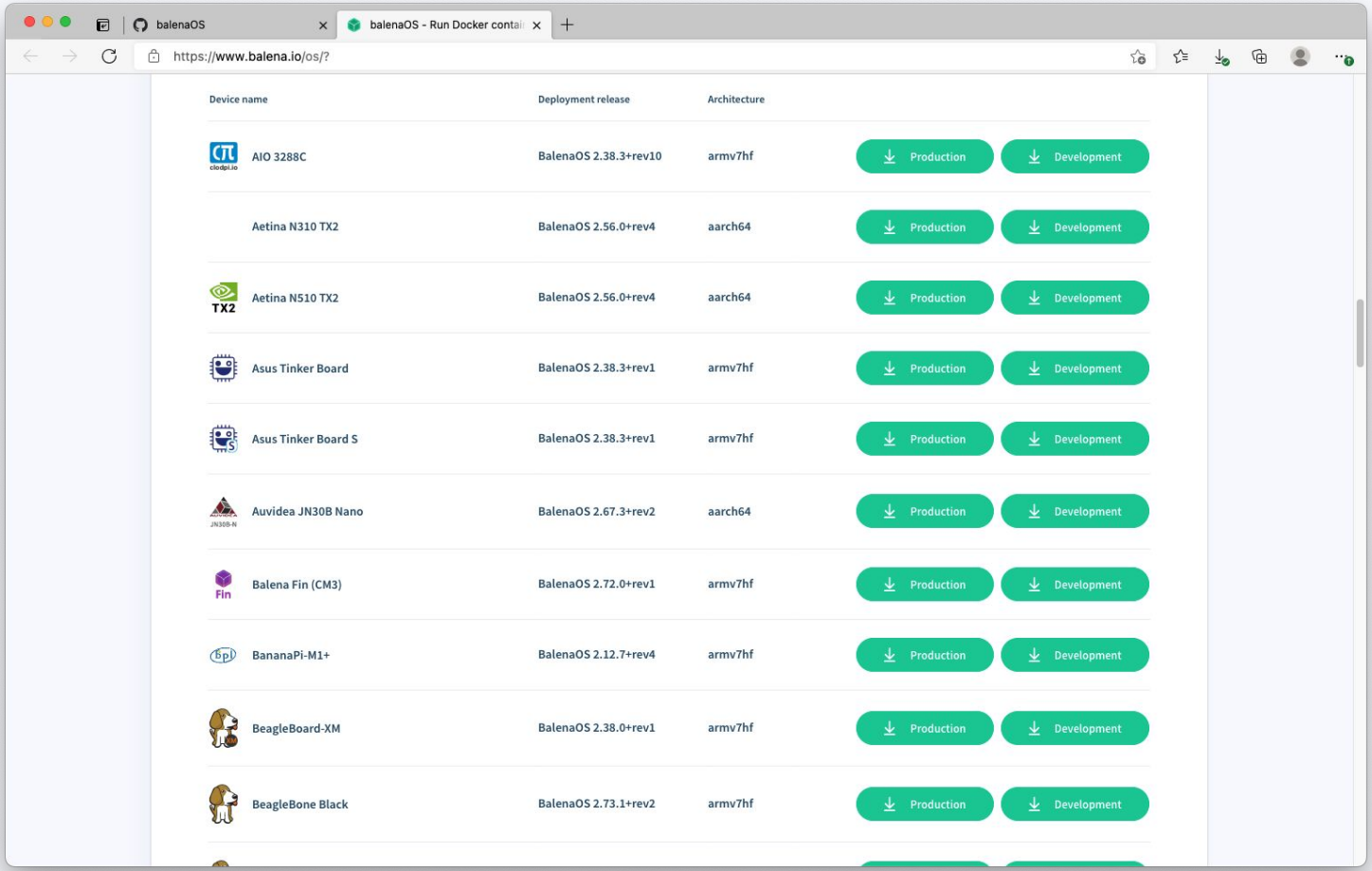
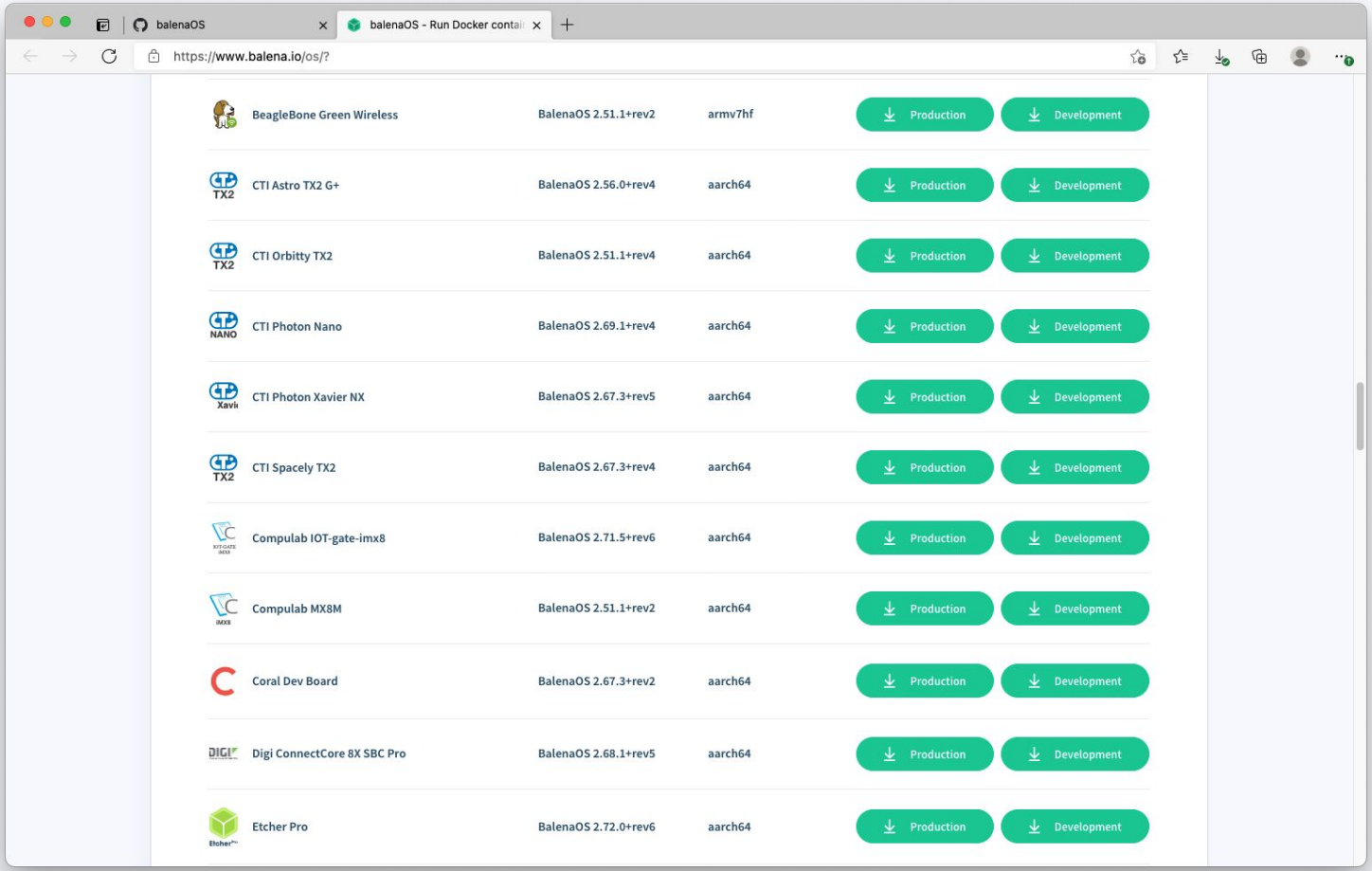
Terminal
Select a target
Start terminal session
Need help

balenaOS

Built on Yocto Linux, Optimized for Embedded Devices and IoT Usage

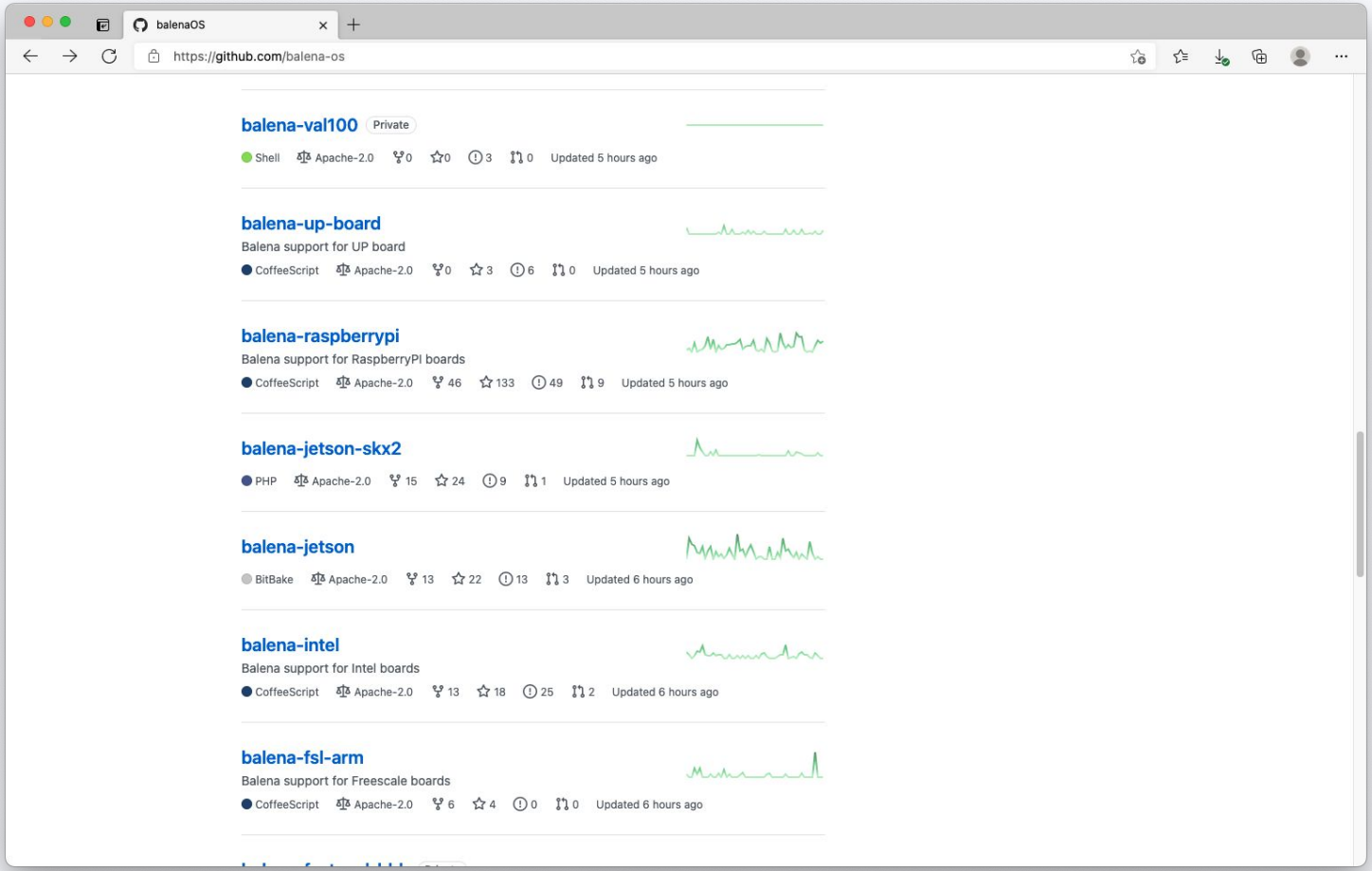
- The Yocto project enables us to build an OS, add a few custom bits, and create a business model around it.
- balenaOS is open source, just like Yocto.

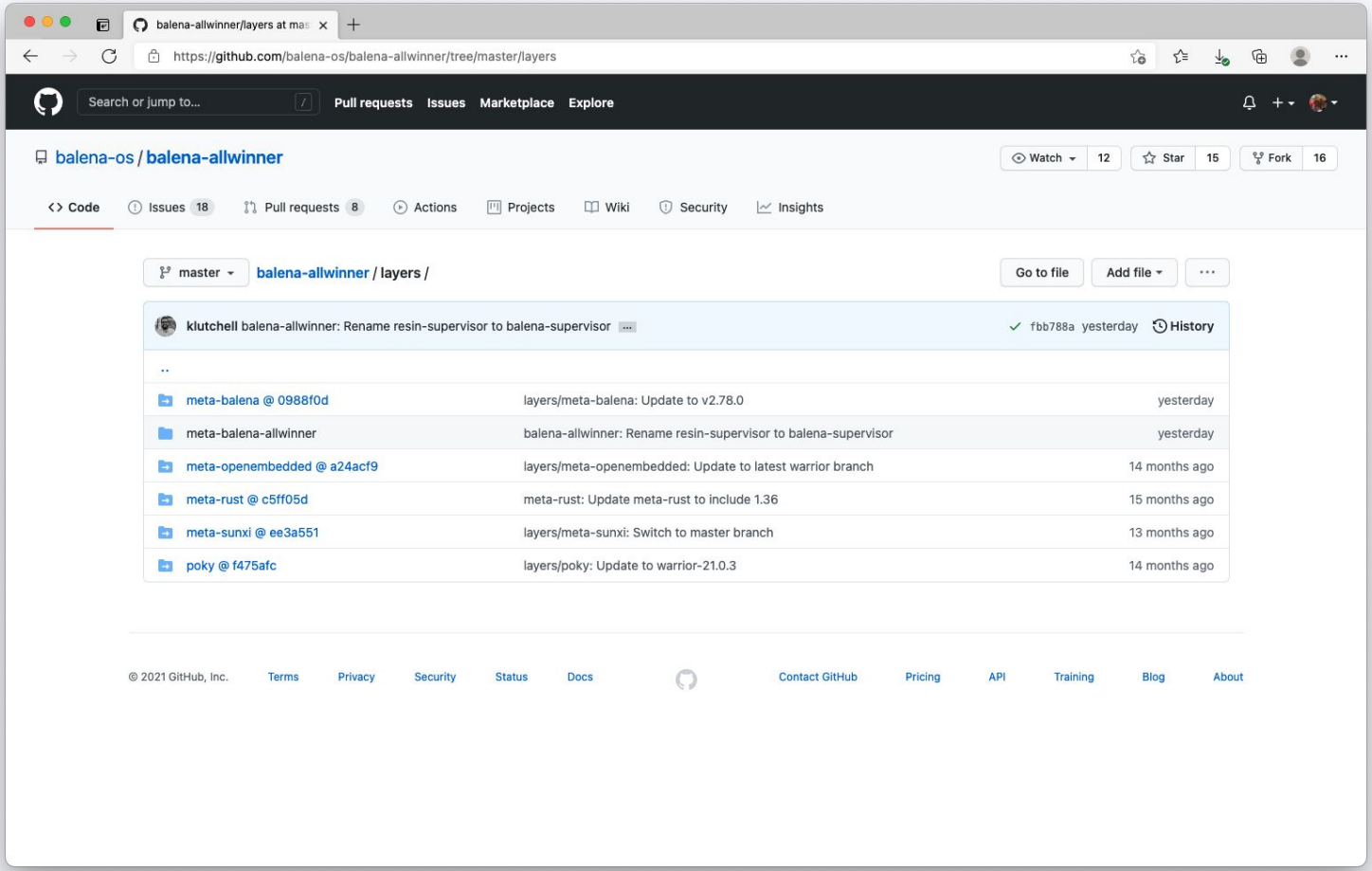

balenaOS
balenaOS - Run Docker contai
https://www.balena.io/os/?
Device name
Deployment release
Architecture
AIO 3288C
BalenaOS 2.38.3+rev10
armv7hf
Production
Development
Aetina N310 TX2
BalenaOS 2.56.0+rev4
aarch64
Production
Development
Aetina N510 TX2
BalenaOS 2.56.0+rev4
aarch64
Production
Development
Asus Tinker Board
BalenaOS 2.38.3+rev1
armv7hf
Production
Development
Asus Tinker Board S
BalenaOS 2.38.3+rev1
armv7hf
Production
Development
Auvidea JN30B Nano
BalenaOS 2.67.3+rev2
aarch64
Production
Development
Balena Fin (CM3)
BalenaOS 2.72.0+rev1
armv7hf
Production
Development
BananaPi-M1+
BalenaOS 2.12.7+rev4
armv7hf
Production
Development
BeagleBoard-XM
BalenaOS 2.38.0+rev1
armv7hf
Production
Development
BeagleBone Black
BalenaOS 2.73.1+rev2
armv7hf
Production
Development


balenaOS
balenaOS - Run Docker contai
https://www.balena.io/os/?
BeagleBone Green Wireless
BalenaOS 2.51.1+rev2
armv7hf
Production
Development
CTI Astro TX2 G+
BalenaOS 2.56.0+rev4
aarch64
Production
Development
CTI Orbitty TX2
BalenaOS 2.51.1+rev4
aarch64
Production
Development
CTI Photon Nano
BalenaOS 2.69.1+rev4
aarch64
Production
Development
CTI Photon Xavier NX
BalenaOS 2.67.3+rev5
aarch64
Production
Development
CTI Spacely TX2
BalenaOS 2.67.3+rev4
aarch64
Production
Development
Compulab IOT-gate-imx8
BalenaOS 2.71.5+rev6
aarch64
Production
Development
Compulab MX8M
BalenaOS 2.51.1+rev2
aarch64
Production
Development
Coral Dev Board
BalenaOS 2.67.3+rev2
aarch64
Production
Development
Digi ConnectCore 8X SBC Pro
BalenaOS 2.68.1+rev5
aarch64
Production
Development
Etcher Pro
BalenaOS 2.72.0+rev6
aarch64
Production
Development

69 Devices in Total

How is this accomplished?


balenaOS
https://github.com/balena-os
balena-val100
Private
Shell Apache-2.0 0 0 3 0 Updated 5 hours ago
balena-up-board
Balena support for UP board
CoffeeScript Apache-2.0 0 3 6 0 Updated 5 hours ago
balena-raspberrypi
Balena support for RaspberryPI boards
CoffeeScript Apache-2.0 46 133 49 9 Updated 5 hours ago
balena-jetson-skx2
PHP Apache-2.0 15 24 9 1 Updated 5 hours ago
balena-jetson
BitBake Apache-2.0 13 22 13 3 Updated 6 hours ago
balena-intel
Balena support for Intel boards
CoffeeScript Apache-2.0 13 18 25 2 Updated 6 hours ago
balena-fsl-arm
Balena support for Freescale boards
CoffeeScript Apache-2.0 6 4 0 0 Updated 6 hours ago


balena-allwinner/layers at mas
https://github.com/balena-os/balena-allwinner/tree/master/layers
Search or jump to...
Pull requests
Issues
Marketplace
Explore
balena-os / balena-allwinner
Watch 12
Star 15
Fork 16
Code
Issues 18
Pull requests 8
Actions
Projects
Wiki
Security
Insights
master
balena-allwinner / layers /
Go to file
Add file
klutchell balena-allwinner: Rename resin-supervisor to balena-supervisor
fbb788a yesterday
History
..
meta-balena @ 0988f0d
layers/meta-balena: Update to v2.78.0
yesterday
meta-balena-allwinner
balena-allwinner: Rename resin-supervisor to balena-supervisor
yesterday
meta-openembedded @ a24acf9
layers/meta-openembedded: Update to latest warrior branch
14 months ago
meta-rust @ c5ff05d
meta-rust: Update meta-rust to include 1.36
15 months ago
meta-sunxi @ ee3a551
layers/meta-sunxi: Switch to master branch
13 months ago
poky @ f475afc
layers/poky: Update to warrior-21.0.3
14 months ago
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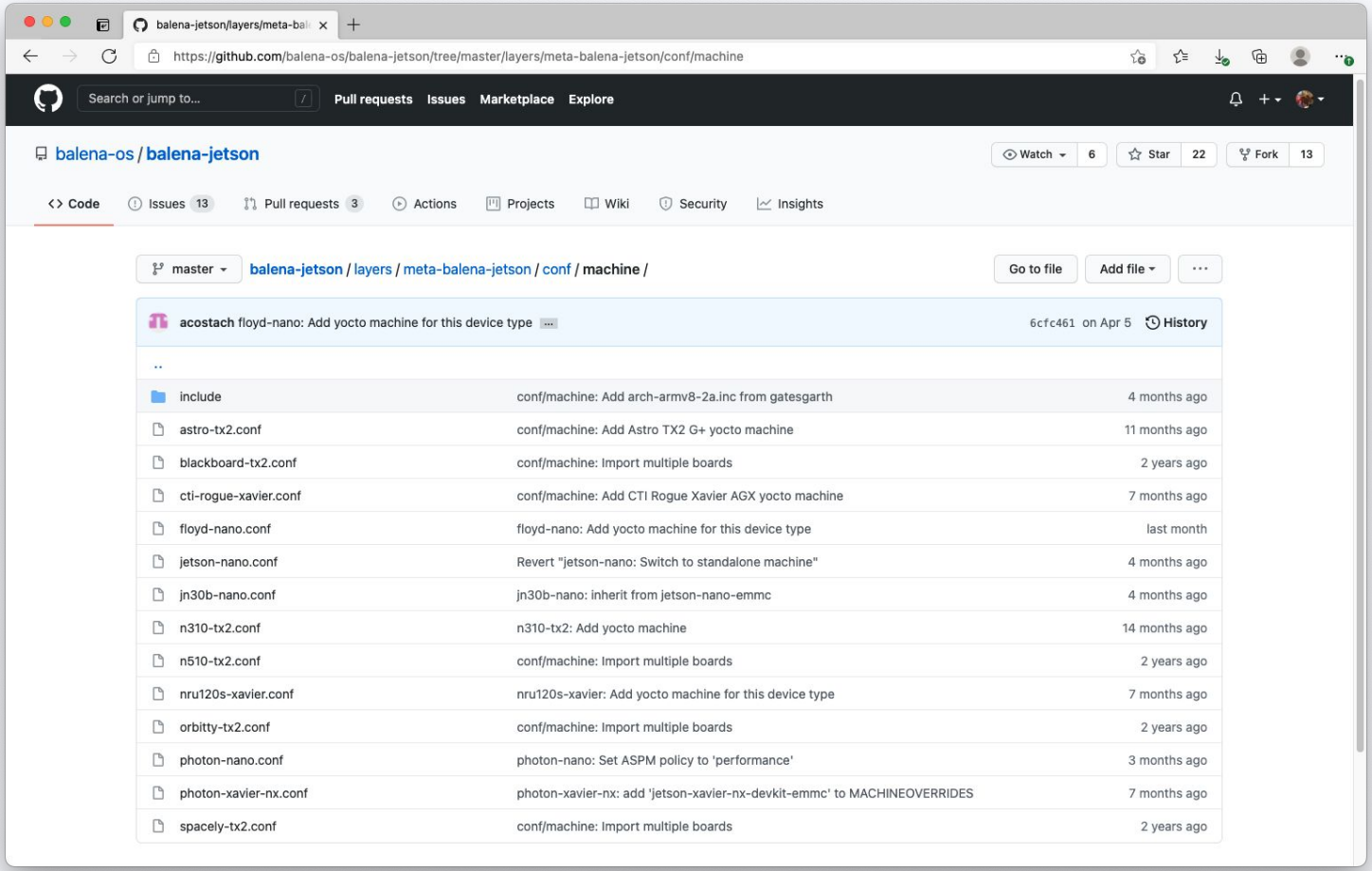
Security
Status
Docs
Contact GitHub
Pricing
API
Training
Blog
About


balena-jetson/layers/meta-bal
https://github.com/balena-os/balena-jetson/tree/master/layers/meta-balena-jetson/conf/machine
Search or jump to...
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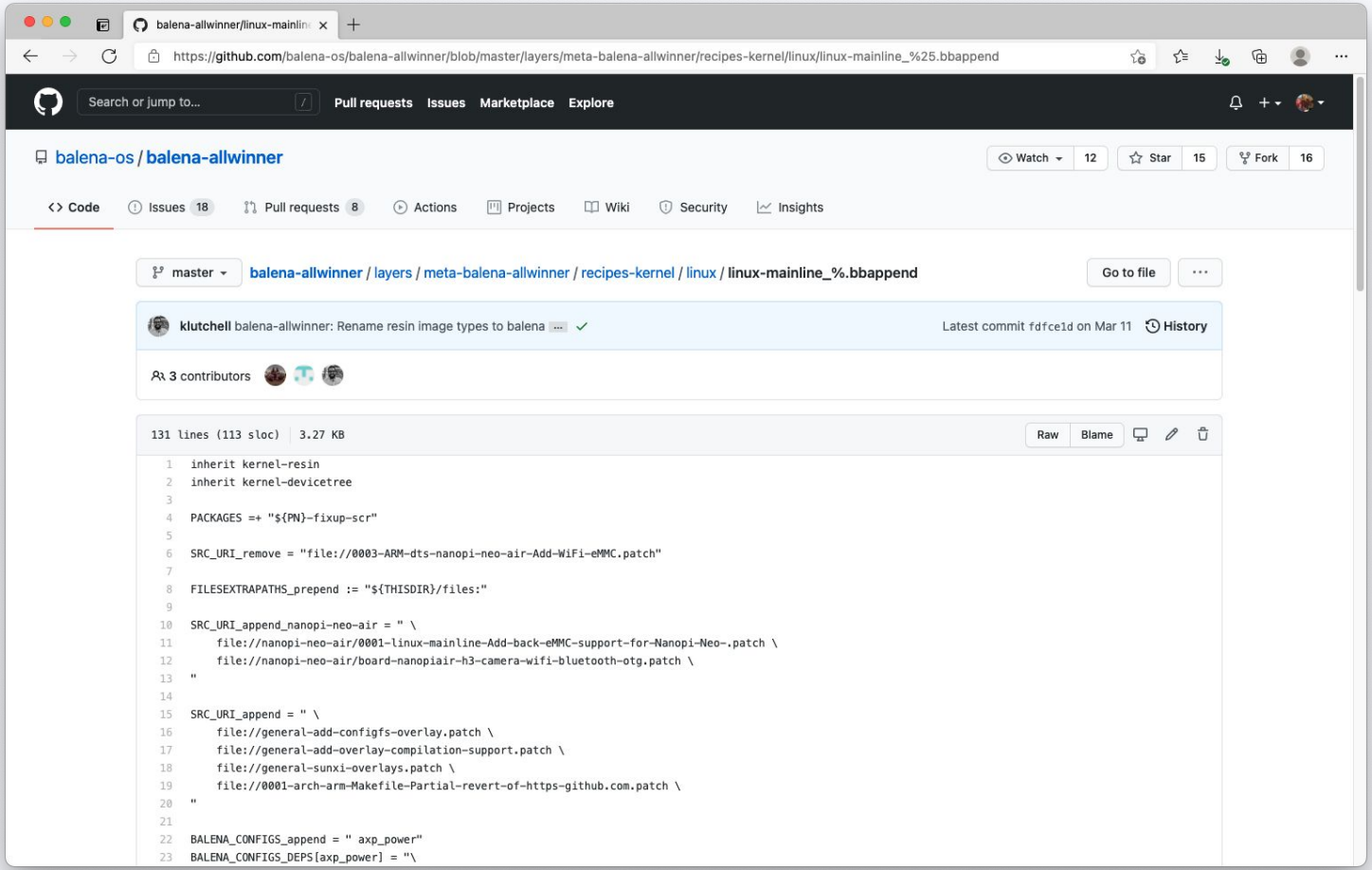
balena-jetson / layers / meta-balena-jetson / conf / machine /
Go to file
Add file
acostach floyd-nano: Add yocto machine for this device type
6cfc461 on Apr 5
History
include conf/machine: Add arch-armv8-2a.inc from gatesgarth 4 months ago
astro-tx2.conf conf/machine: Add Astro TX2 G+ yocto machine 11 months ago
blackboard-tx2.conf conf/machine: Import multiple boards 2 years ago
cti-rogue-xavier.conf conf/machine: Add CTI Rogue Xavier AGX yocto machine 7 months ago
floyd-nano.conf floyd-nano: Add yocto machine for this device type last month
jetson-nano.conf Revert "jetson-nano: Switch to standalone machine" 4 months ago
jn30b-nano.conf jn30b-nano: inherit from jetson-nano-emmc 4 months ago
n310-tx2.conf n310-tx2: Add yocto machine 14 months ago
n510-tx2.conf conf/machine: Import multiple boards 2 years ago
nru120s-xavier.conf nru120s-xavier: Add yocto machine for this device type 7 months ago
orbitty-tx2.conf conf/machine: Import multiple boards 2 years ago
photon-nano.conf photon-nano: Set ASPM policy to 'performance' 3 months ago
photon-xavier-nx.conf photon-xavier-nx: add 'jetson-xavier-nx-devkit-emmc' to MACHINEOVERRIDES 7 months ago
spacely-tx2.conf conf/machine: Import multiple boards 2 years ago


balena-allwinner/linux-mainlin
https://github.com/balena-os/balena-allwinner/blob/master/layers/meta-balena-allwinner/recipes-kernel/linux/linux-mainline_%25.bbappend
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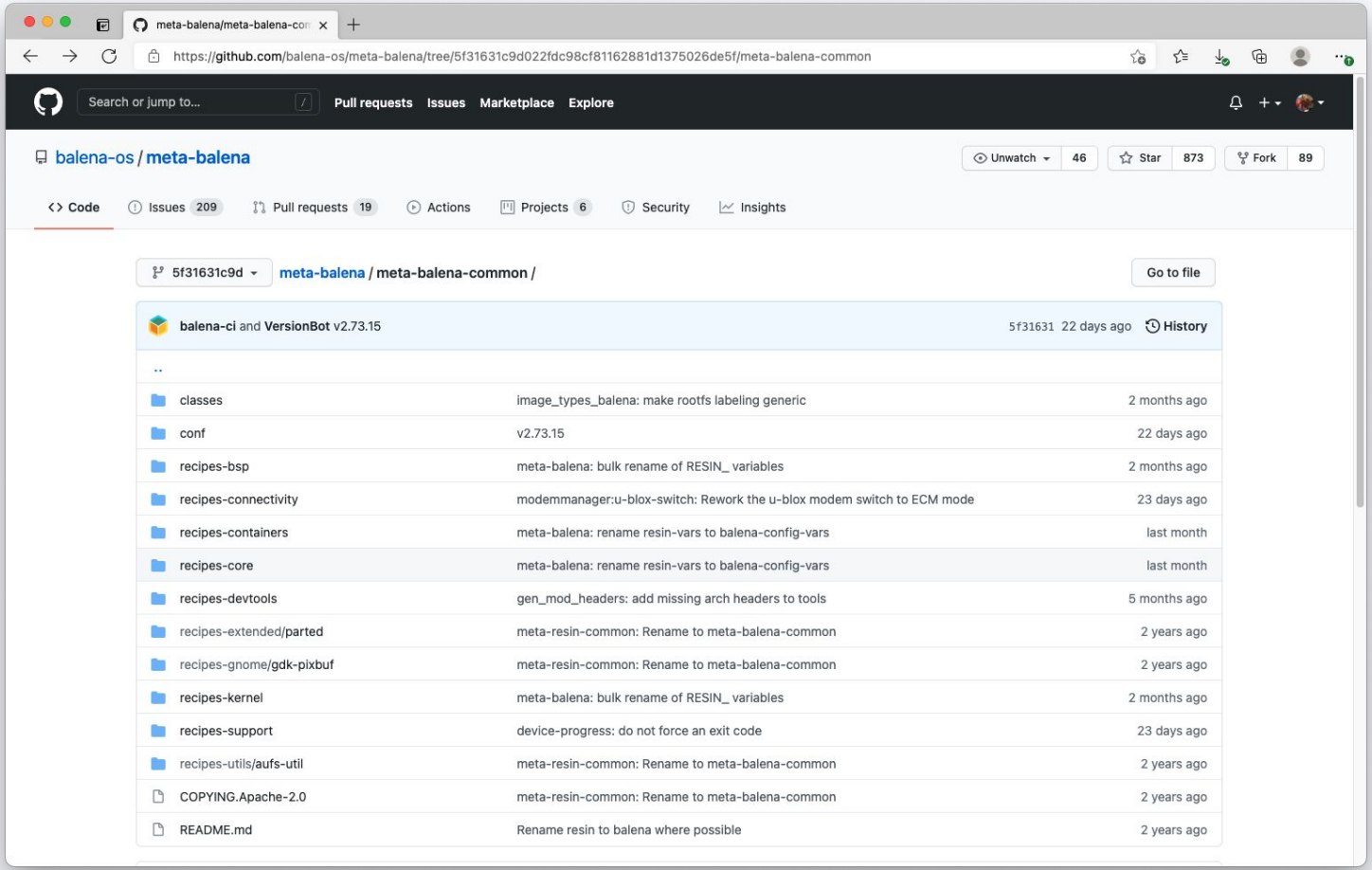
balena-allwinner / layers / meta-balena-allwinner / recipes-kernel / linux / linux-mainline_%.bbappend
Go to file
klutchell balena-allwinner: Rename resin image types to balena
Latest commit fdfce1d on Mar 11
History
3 contributors
131 lines (113 sloc) 3.27 KB
Raw
Blame
1 inherit kernel-resin
2 inherit kernel-devicetree
3
4 PACKAGES =+ "${PN}-fixup-scr"
5
6 SRC_URI_remove = "file://0003-ARM-dts-nanopi-neo-air-Add-WiFi-eMMC.patch"
7
8 FILESEXTRAPATHS_prepend := "${THISDIR}/files:"
9
10 SRC_URI_append_nanopi-neo-air = " \
11 file://nanopi-neo-air/0001-linux-mainline-Add-back-eMMC-support-for-Nanopi-Neo-.patch \
12 file://nanopi-neo-air/board-nanopiair-h3-camera-wifi-bluetooth-otg.patch \
13 "
14
15 SRC_URI_append = " \
16 file://general-add-configfs-overlay.patch \
17 file://general-add-overlay-compilation-support.patch \
18 file://general-sunxi-overlays.patch \
19 file://0001-arch-arm-Makefile-Partial-revert-of-https-github.com.patch \
20 "
21
22 BALENA_CONFIGS_append = " axp_power"
23 BALENA_CONFIGS_DEPS[axp_power] = "\


meta-balena/meta-balena-con
https://github.com/balena-os/meta-balena/tree/5f31631c9d022fdc98cf81162881d1375026de5f/meta-balena-common
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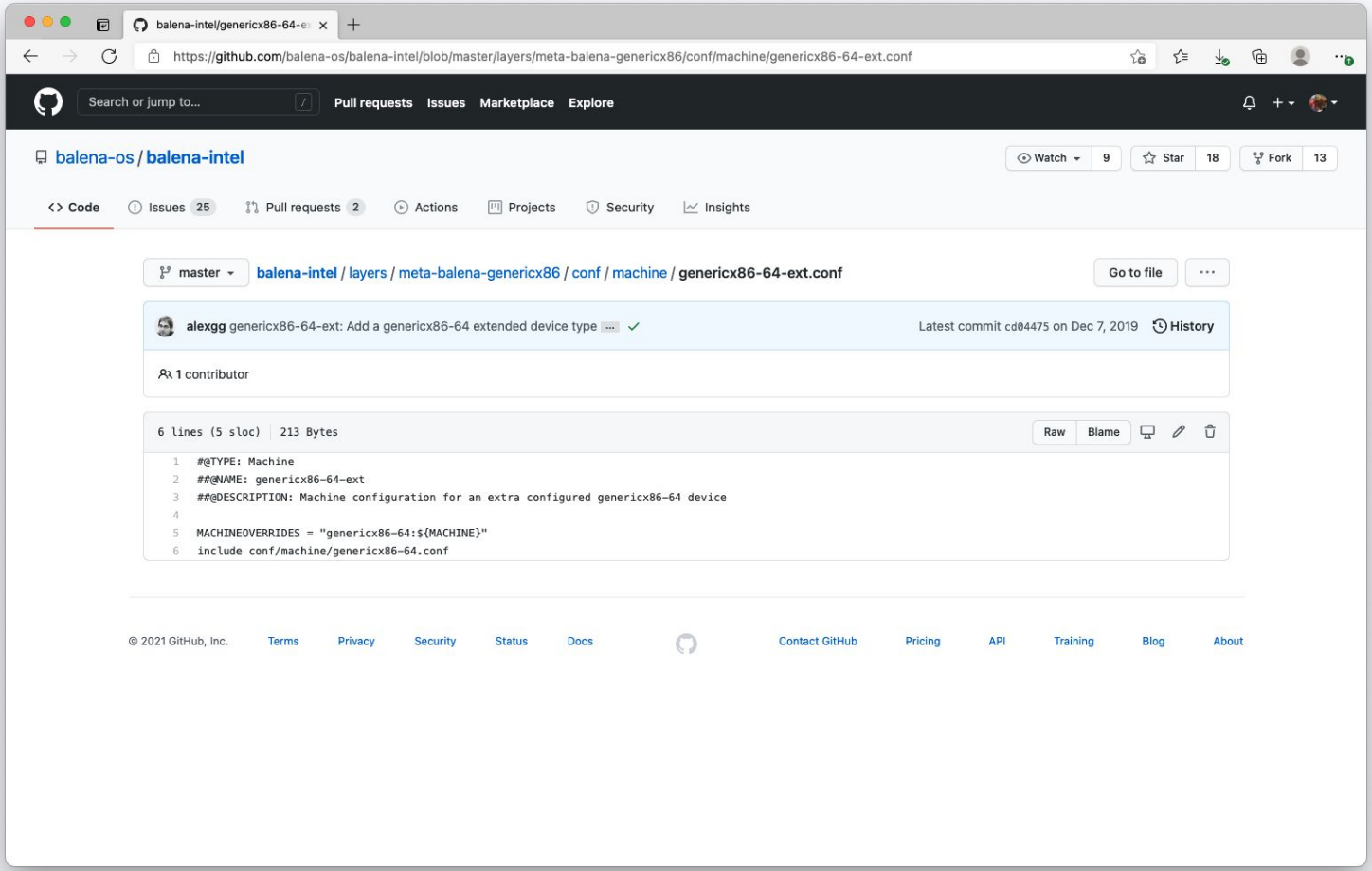
5f31631c9d
meta-balena / meta-balena-common /
Go to file
balena-ci and VersionBot v2.73.15
5f31631 22 days ago
History
..
classes image_types_balena: make rootfs labeling generic 2 months ago
conf v2.73.15 22 days ago
recipes-bsp meta-balena: bulk rename of RESIN_ variables 2 months ago
recipes-connectivity modemmanager:u-blox-switch: Rework the u-blox modem switch to ECM mode 23 days ago
recipes-containers meta-balena: rename resin-vars to balena-config-vars last month
recipes-core meta-balena: rename resin-vars to balena-config-vars last month
recipes-devtools gen_mod_headers: add missing arch headers to tools 5 months ago
recipes-extended/parted meta-resin-common: Rename to meta-balena-common 2 years ago
recipes-gnome/gdk-pixbuf meta-resin-common: Rename to meta-balena-common 2 years ago
recipes-kernel meta-balena: bulk rename of RESIN_ variables 2 months ago
recipes-support device-progress: do not force an exit code 23 days ago
recipes-utils/aufs-util meta-resin-common: Rename to meta-balena-common 2 years ago
COPYING.Apache-2.0 meta-resin-common: Rename to meta-balena-common 2 years ago
README.md Rename resin to balena where possible 2 years ago


balena-intel/genericx86-64-ex
https://github.com/balena-os/balena-intel/blob/master/layers/meta-balena-genericx86/conf/machine/genericx86-64-ext.conf
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master
balena-intel / layers / meta-balena-genericx86 / conf / machine / genericx86-64-ext.conf
Go to file
alexgg genericx86-64-ext: Add a genericx86-64 extended device type
Latest commit cd04475 on Dec 7, 2019
History
1 contributor
6 lines (5 sloc) 213 Bytes
Raw
Blame
#@TYPE: Machine
##@NAME: genericx86-64-ext
##@DESCRIPTION: Machine configuration for an extra configured genericx86-64 device
MACHINEOVERRIDES = "genericx86-64:${MACHINE}"
include conf/machine/genericx86-64.conf
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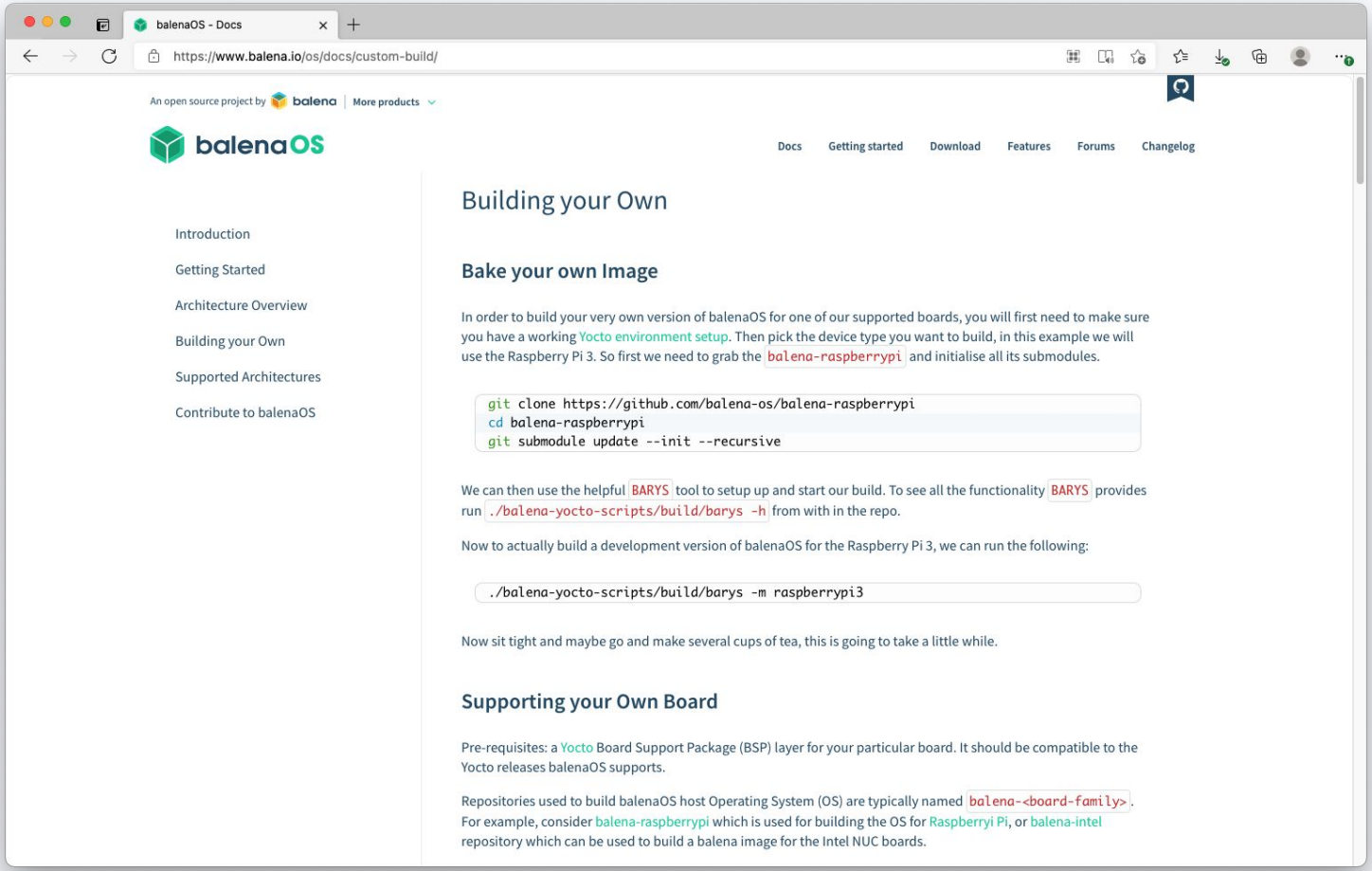
Repeat 68 more times

Adding a new board

https://github.com/balena-os

- Does your board have a Yocto build already?
- Check for existing “similar” boards
  - SoC Manufacturer
  - Product Line
- If so, clone the appropriate repo and begin porting in your board
- If not, then you will need to go the longer way (but not terrible), which is starting from scratch as documented here:
  - https://www.balena.io/os/docs/custom-build/


balenaOS - Docs
https://www.balena.io/os/docs/custom-build/
An open source project by balena | More products
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Architecture Overview
Building your Own
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Contribute to balenaOS
Building your Own
Bake your own Image
In order to build your very own version of balenaOS for one of our supported boards, you will first need to make sure you have a working Yocto environment setup. Then pick the device type you want to build, in this example we will use the Raspberry Pi 3. So first we need to grab the balena-raspberrypi and initialise all its submodules.
git clone https://github.com/balena-os/balena-raspberrypi
cd balena-raspberrypi
git submodule update --init --recursive
We can then use the helpful BARYS tool to setup up and start our build. To see all the functionality BARYS provides run ./balena-yocto-scripts/build/barys -h from with in the repo.
Now to actually build a development version of balenaOS for the Raspberry Pi 3, we can run the following:
./balena-yocto-scripts/build/barys -m raspberrypi3
Now sit tight and maybe go and make several cups of tea, this is going to take a little while.
Supporting your Own Board
Pre-requisites: a Yocto Board Support Package (BSP) layer for your particular board. It should be compatible to the Yocto releases balenaOS supports.
Repositories used to build balenaOS host Operating System (OS) are typically named balena-<board-family>. For example, consider balena-raspberrypi which is used for building the OS for Raspberryi Pi, or balena-intel repository which can be used to build a balena image for the Intel NUC boards.

Yocto Project Call-to-Action

- https://lists.yoctoproject.org/g/yocto/topic/open_source_maintainers_an/82722441
  - There are a few things companies can do to help:
    - a) Publicly acknowledge you use the project.
    - b) Embrace employee's Open Source contributions, code and otherwise
    - c) Consider Yocto Project membership
    - d) Support employees in spending some time on open source projects
    - e) Transition roles

- https://www.yoctoproject.org/join/

Additional Resources

balena Blog: https://www.balena.io/blog/

balena Forums: https://forums.balena.io/

balena-os GitHub: https://github.com/balena-os

IoT
Happy
HOUR
Weekly IoT hangout & freeform chat
Fridays | 4 PM UTC

Questions / Q&A

David Tischler
Developer Advocate
t: @balena_io
e: david@balena.io

balena